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Article Title: **Flextural Behaviour of Ferro Cement Slab by Using GGBS and Nano Silica by Using ANSYS Software**

Flextural Behaviour of Ferro Cement Slab by Using GGBS and Nano Silica by Using ANSYS Software

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ABSTRACT

The use non – corrodible reinforcements in Ferro cement slabs may prevent its failure corrosion of welded mesh. Ferro cement slab of 700 x 150 x 20 mm & 700 x 150 x 30mm. The ratio of cement and fine aggregate is 1: 2 with the addition of geo polymer such as GGBS and Fly ash. The GGBS are added as 20%, 40%, 60%, 80% by weight of cement directly into the mortar while mixing. GGBS Fly ash, Fine aggregate, water, Nano Silica is the material used for this investigation. The grade of cement is OPC 53 and grade of Fly ash is class F. The material testing of fine aggregate, fly ash, GGBS were conducted and observed result within the limits. Also, the literature survey was done related to the experimental work with GGBS, Fly ash. The tests are conducted to determine various properties of Ferro cement such as corrosion, failure pattern, tension and punching load. It is eco – friendly and cost – effective. Geo polymer mortar achieved considerable strength with the addition of GGBS with fly ash based geo polymer Slab by using ansys Software.

Keywords: Fly ash, GGBS (Ground Granulated Blast-furnace Slag), Nano Silica, weld mesh.

1 Introduction

The overall usage of OPC and PPC plays an important role in global warming and environmental pollution. The world's atmosphere is mostly enveloped with 7% of hazardous gases due to cement production. The overall global heat is also raised year by year. This can be only minimized by using alternative material on behalf of cement. In this present study, the cement mortar is totally avoided in the ferrocement slabs. The cement mortar is replaced by geopolymer mortar. Some of the properties, which vary hugely when compared to cement mortar are cost, setting time, curing temperature, method and strength. Ferrocement has a widespread use in field of construction industry.

The most widely employed additive that improves the viscosity and density has been coal ash. While utilized in ferrocement, fly ash would be environmentally sustainable additive. The use of fly ash for cement enhances the performance and adds to long – term durability (Khatlif et al. 2008). Because of the incorporation of fly ash, the SP concentration into free lime throughout time and enhances the toughness. Fly ash performs a significant function in strengthening concrete thickness and further reducing permeability.

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Aggressive substances remain deposited on the outer region of the mortar caused to reduce permeability. Fly ash is resistant to sulfate attacks. Characteristics by the inclusion of fly ash, aggressive alkali activity is significantly decreased. Efflorescence is also reduced by fly ash. The following are certain advantages of employing fly ash.

Ground granulated blast furnace slag (GGBS or GGBFS) is obtained by quenching molten iron slag (a by – product of iron and steel – making) for a blast furnace in water or stream, to produce a glassy, granular product that is then dried and ground into a fine powder. Ground – granulated blast furnace slag is highly cementitious and high in calcium silicate hydrates (CSH) which is a strength enhancing compound which improves the strength, durability and appearance of the concrete.

Ferrocement has proven itself as an excellent material for building construction as well as repair material. Ferrocement is a type of thin walled reinforced concrete commonly constructed of hydraulic cement mortar reinforced with closely spaced layers of continuous and relatively small size wire mesh. The mesh may be materials. In 1940 Pier Luigi Nervy, at Italian engineer, architect and contractor, used ferrocement first for the construction of aircraft hangars, boats and buildings and also in variety of other structures. Ferrocement is an attractive material for the construction of barges, prefabricated housing units, construction of domes and folded plates due to its reduced thickness. Ferrocement possesses high performances characteristic, especially in cracking, strength, ductility and impact resistance.

The aim of this project is to increase the flexural properties of ferrocement slabs by replacing cement with geopolymers like Fly Ash and GGBS. The main objective of the project is to compare the flexural behaviour of the conventional ferrocement geopolymer slab. To obtain the optimum strength of the ferrocement geopolymer slab. ANSYS is a general purpose software, used to simulate interactions of all disciplines of physics, structural, vibration, fluid dynamics, heat transfer and electromagnetic for engineers. So ANSYS, which enables to simulate tests or working conditions, enables to test in virtual environmental before manufacturing prototypes of products. Furthermore, determining and improving weak points, computing life and foreseeing probable problems are possible by 3D simulations in virtual environment. ANSYS software with its modular structure as seen in the table below gives an opportunity for taking only needed features. ANSYS can work integrated with other used engineering software on desktop by adding CAD and FEA connection modules. The finite element method (FEM) is a numerical method for solving problems engineering and mathematical physics. It is also referred to as finite element analysis (FEA). Typical problem areas of interest include structural analysis, heat transfer, fluid flow, mass transport, and electromagnetic potential.

2 Recent Work

Conhyea et al. “Potential use of Fly Ash as partial replacement of cement in concrete” (2020), Plani et al. “The flexural behaviour of ferrocement panel with the incorporation of silica fume

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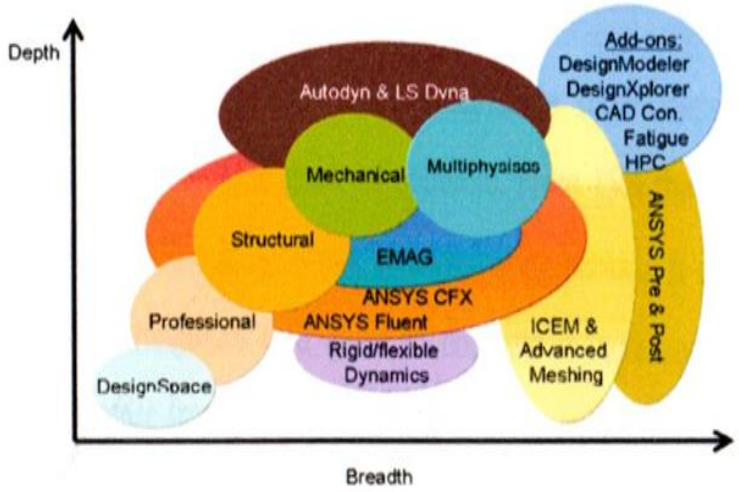

Materials and Methods

Cement	M-sand	W/c Ratio
1	2	0.4

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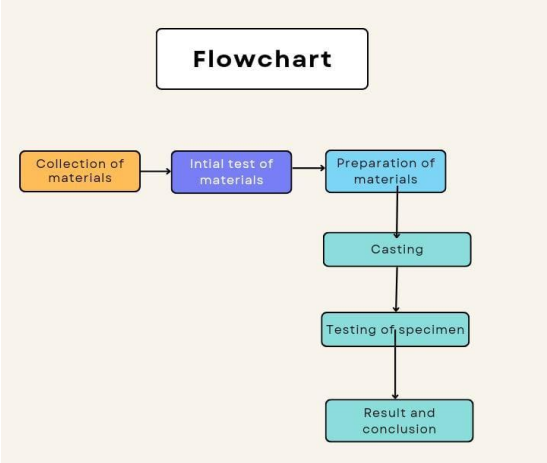


3 Experimental Analysis

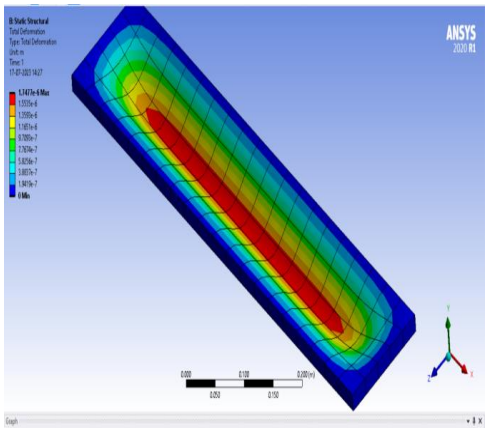
3.1 Flexural Strength Test

Flexural strength is the ability of slab to resist failure in bending. It is measured by loading reinforced slab with a span of 700 x 150 x 20mm. Two point loading test is conducted based on the British Standard BS 1881-118 (1983), method for determination of flexural strength. This method describes the determination of flexural strength of test specimens of mortor by moment in the cenre zone using two point loading (BSI 1983).

The load was directly measured by the unit test and the vertical deflection on the load reading was appeared on the screen of the machine The vertical deflection was measured by linear variable differential transducers (LVDT) located at the centre of the specimen using magnetic stand. The load and deflection data required for each test specimen was recorded from data logger UCAM-70A.

4 Result and Discussion

4.1 Software and Analysis



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4.2 Experimental and Result

% of Fly ash	% of GGBS	Thickness of slab	Flexural strength @7 days	Flexural strength @ 14 days	Flexural strength@ 28 days
80	20	20mm	3.65	3.8	4.24
60	40	20mm	4.77	5.38	5.75
40	60	20mm	4.9	5.68	5.8
20	80	20mm	5.07	6.08	6.38

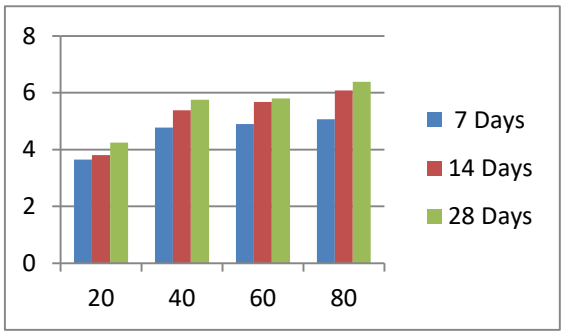
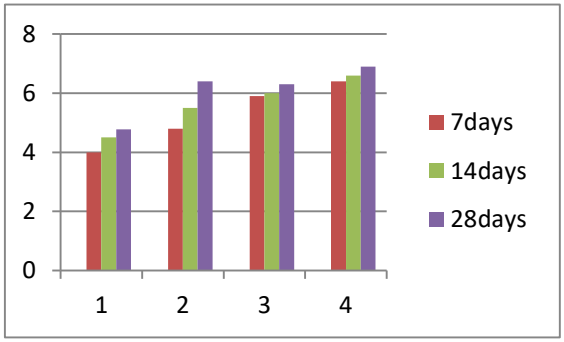


Figure 1: *Flexural Strength of 30 mm slab*

% of Fly ash	% of GGBS	Thickness of slab	Flexural strength@ 7 days	Flexural strength@ 14 days	Flexural strength @ 28 days
80	20	30mm	4	4.5	4.78
60	40	30mm	4.8	5.5	6.1
40	60	30mm	5.9	6	6.3
20	80	30mm	6.4	6.6	6.9



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Comparing the flexural strength of slabs size of 30 mm and 20 mm for 7 days 14 days and 28 days by the addition of GGBS and fly ash in percentage as the replacement of cement the 28 days of 30 mm slab is gives most strength than the 20 mm slab the maximum strength is obtained in 30 mm slab.

5 Conclusion

The use non – corrodible reinforcements in Ferro cement slabs may prevent its failure corrosion of welded mesh. Ferro cement slab of 700 x 150 x 20 mm & 700 x 150 x 30mm. Comparing the flexural strength of slabs size of 30 mm and 20 mm for 7 days 14 days and 28 days by the addition of GGBS and fly ash in percentage as the replacement of cement the 28 days of 30 mm slab is gives most strength than the 20 mm slab the maximum strength is obtained in 30 mm slab. Cement can be replaced by using fly ash, GGBS in the preparation of geopolymer. It is observed that increase in GGBS content reduces the setting time and increases the degree of workability. Flexural strength 80% replacement of cement shows maximum strength. The strength of flyash based geopolymer mortor with the addition of GGBS got increased of its flexural strength.

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